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Rev A
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Payload Integration Plan

(NASA-TM-80822) PAYLOAD INTEGRATION PLAN: SPACE TRANSPORTATION SYSTEM AND SYNCOM 4 (NASA) 33 p

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Space Transportation System and SYNCOM IV

October 1979

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Revision A

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CHANGE SHEET
FOR
STS AND SYNCOM IV
REVISION A CHANGE 1

CHANGE INSTRUCTIONS

1. Remove the following listed pages and replace with the same numbered attached page:

Page	CR/DIR NO.
i	--
ii	--
9	P14000-4
10	P14000-4
13	--
14	P14000-4
19	P14000-4
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21	--
22	P14000-4
23	P14000-4
24	--
25	P14000-4
A-1	--

Note: A black bar in the right hand margin indicates the information that was added or changed.

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Signature of person incorporating changes in the document — Date

11/20/79

REVISIONS

REV LTR	CHANGE NO.	DESCRIPTION	DATE
A	--	Miscellaneous changes and Baseline issue per CR/DIR P14000-1, -2, -3	10/12/79
--	1	Document update per CR/DIR P14000-4	11/20/79

STS AND SYNCOM
PAYLOAD INTEGRATION PLAN

LIST OF EFFECTIVE PAGES

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CHANGE 1 11/20/79

The current status of the document change pages is as shown below:

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*14	11/20/79		
15	10/12/79		
16	10/12/79		
17	10/12/79		

TABLE 4-3 ORBITER STATE VECTOR UNCERTAINTY AT DEPLOYMENT (3σ)

POSITION, ft			VELOCITY, fps		
RADIAL	INTRACK	CROSS TRACK	RADIAL	INTRACK	CROSS TRACK
4,921	34,450	4,921	38.4	5.9	9.8

5.2 Cable Interfaces

The S-IV will use one section of the standard AFD and payload harnesses in accordance with the mixed user allocation section of JSC 07700 Vol. XIV and as an optional service STS will provide harnesses for utilization of the MDM PF-2 functions which include six analog and 10 digital signals.

Specific wiring pin function asignments will be defined in the STS/SYNCOM IV ICD.

5.3 Display and Control Interfaces

Display and control functions are accomplished using the following crew-controlled equipment:

1 Section of the Standard Switch Panel

Assignment of functions and nomenclature for the switch panel functions are to be defined in the Orbiter Crew Compartment Annex to this PIP.

Requirements for display and control functions accomplished using the Orbiter general purpose computer/keyboard/CRT combination are to be defined by HCSI in the Command and Data Annex to the PIP.

5.4 Electrical Power Interfaces

For SYNCOM IV ground operations prior to installation in the STS, power will be supplied to the SYNCOM IV using HCSI-provided electrical ground support equipment. During the STS/SYNCOM IV ground and flight-mated operations, power will be supplied by the STS as defined in the following paragraphs.

SYNCOM IV shall provide means for cradle electronics power activation/ deactivation via crew control and for fusing and or circuit breaker protection of its power circuits from the Orbiter.

Electrical power interface requirements at the payload interface for the minimum expected voltage are as follows:

Power Source	Prelaunch	Launch	Payload deployment Prior To	Payload deployment After
a) Orbiter cargo bay bus	2000W(3)	N/A	2000W(1)	330W(2)
b) Orbiter AFD D.C. bus	100W(3)	N/A	100W	100W

Note: 1. Required primarily for earth and deep space facing.

Note: 2. Required for deep space facing with only 30 watts required for earth facing.

Note: 3. During prelaunch payload interface verification only prior to cargo bay doors closeout.

The specific power profile will be defined by HCSI in the Flight Planning Annex.

5.5 Command Interfaces

The command interfaces are:

Commands Interface/Source	Prelaunch	Launch	Payload Deployment Prior To	Payload Deployment After
a. Hardwire from Standard Switch Panel	X	N/A	X	X
b. Hardwire from MDM's PF-1 and PF-2	X	N/A	X	N/A

5.6 Telemetry and Data Interfaces

There is no telemetry interface of the SYNCOM IV to the STS. Data interfaces are as follows.

Data Interface/Route	Prelaunch	Launch	Payload deployment Prior To	Payload deployment After	Payload deployment Landing
a) Hardwire to Standard Switch Panel	X	N/A	X	X	N/A
b) SYNCOM IV to MDM's PF-1 and PF-2	X	N/A	X	X	N/A

radiated levels outside the payload envelope incident on other cargo elements within the cargo bay shall be limited to those levels specified in Figure 10.7.3.2-3 in ICD 2-19001 at S-band frequencies and below and not to exceed S-band levels above S-band frequencies.

6.4 Contamination

The HCSI is responsible for assuring that the payload is compatible with the induced contamination environment and complies with the outgassing requirements as defined in ICD 2-19001.

6.5 Shock, Vibration and Acoustic Environments

The SYNCOM IV is responsible for compatibility with the STS induced shock, vibration and acoustic environments defined in ICD 2-19001.

6.6 Ground Environmental Requirements

Load factors for ground handling and transportation hardware for the SYNCOM IV shall not exceed those specified in the Launch Site Accommodations Handbook, K-STSM-14.1.

Environmental conditions and cleanliness levels of SAEF-2, Vertical Processing Facility, canister and the Rotating Service Structure are also defined in the Launch Site Accommodations Handbook, K-STS-14.1.

After cargo bay door closure until launch conditioned air/GN_2 will be provided for cargo bay purge between 60-70^{o} F.

6.7 Orbiter/SYNCOM IV Separation Analysis

The S-IV Program shall conduct an analysis of separation dynamics, including worst case dispersions, of SYNCOM IV separation from the Orbiter. The STS will provide the Orbiter initial conditions and geometry, in support of the analysis. The analytical results will be provided by S-IV Program to the STS according to the schedule in section 15.

7.0 INTEGRATION HARDWARE AND SERVICES

The responsibilities for the integration hardware are defined in the following paragraphs.

7.1 STS Provided Hardware

a) STS will provide the four passive longeron and one active keel attach fittings.

b) STS will provide the cargo bay wire harnesses, including power, from the respective STS power and signal interfaces to the SYNCOM IV cradle interface.

c) STS will provide a Standard Switch Panel in the Aft Flight Deck (AFD).

d) STS will provide as an optional service harnesses for 16 MDM parameters (six analog and 10 digital).

e) STS will provide as an optional service air transportation from Los Angeles to KSC for the Syncom IV payload.

7.2 Payload-Provided Hardware

SYNCOM IV will provide the payload half of the cradle electrical connectors.

8.0 FLIGHT OPERATIONS

This section defines the flight design, flight activity planning, flight crew and flight controller training and flight operations support activities required for SYNCOM IV/STS integration.

8.1 Flight Design

The STS will be responsible for performing integrated mission analysis from lift-off until SYNCOM IV separation. The constraints for flight design are defined in Section 4. SYNCOM IV will provide information to support the analysis in the Flight Planning Annex. The SYNCOM IV program will be responsible for the detached SYNCOM IV orbital flight requirements.

8.2 Flight Activity Planning

8.2.1 Crew Activity Plan.- The STS will be responsible for all crew activity plans and will develop an integrated summary STS/SYNCOM IV crew activity plan to support the flight. Included in the plan will be the HCSI supplied payload sequence of events. The HCSI will provide this sequence of events as part of the Flight Planning Annex.

8.2.2 Payload Operating Procedures.- HCSI is responsible for the development and verification of payload operating procedures. The payload operating procedures are provided by HCSI and transmitted to the STS via the Flight Operations Support Annnex of the PIP. These procedures will be used by the STS to generate the integrated STS/payload procedures.

8.3 Training

The STS will be responsible for providing the crew training plans and crew training required for the STS/SYNCOM IV flight. The SYNCOM IV program is

11.0 INTERFACE VERIFICATION

The payload is responsible for verifying compatibility with the interfaces and environments specified in the PIP and applicable ICD's. The non-safety associated interface verification requirements and planning will be negotiated and concurred in by the STS and HCSI. It is anticipated that this interface verification will be accomplished within the scope of normal test, checkout and integration flow of the SYNCOM IV spacecraft. Included within the flow at VPF is a Cargo Integration Test to verify pre-installation electrical and mechanical compatibility with the STS. The interface verification requirements are specified in Volume XIV, PIV 01.

12.0 POSTFLIGHT DATA REQUIREMENTS

Copies of the deployment photography will be provided.

13.0 OPTIONAL SERVICES

Planning and budget estimates of reimbursements for the payload transportation requirements and the above optional services are displayed in the STS Summary Price Sheet, figure 13-1. These estimates are intended to provide preliminary information on the assumed level of cost to be borne by HCSI and will change through more detailed definition and joint negotiations. The estimates are stated in current year dollars and the use of these estimates for planning purposes should be adjusted for inflation. The final estimates for Standard Shuttle Services and Optional Flight System Services will be jointly negotiated between NASA Headquarters and the HCSI in the Launch Services Agreement. Immediately prior to the initiation of the individual optional service, the performing NASA organization and HCSI will jointly define the tasks and negotiate the final firm price on a firm price sheet according to the section 15 schedule for the optional service.

1. Reference Section 5.2 and 7.1d - The STS will provide harnesses for 16 MDM parameters (six analog and 10 digital).

2. Reference Section 6.1 - The STS will perform one Design Support Loads cycle documented in a SYNCOM IV/STS Loads Report and provide to HCSI.

3. Reference Section 7.1e - The STS will provide Super Guppy air transportation for the SYNCOM IV from Los Angeles, Calif. to KSC Florida.

4. Reference Section 9.0 - The off line facilities use charges and launch site support management and services are provided as an optional services.

14.0 PIP ANNEXES

As identified in other section of the document, the following annexes are required:

1. Payload Data Package

2. Flight Planning

3. Flight Operations Support

4. Orbiter Command and Data

5. POCC Volume 2

6. Orbiter Crew Compartment

8. Launch Site Support Plan

15.0 SCHEDULE

The attached schedule, figure 15-1, provides a summary of the various technical areas requiring data exchange and/or products in support of the SYNCOM IV/STS integration activities.

The data indicated in Figure 15-1 under, "Reference Milestones", are included for information only and are controlled by the STS or User organization.

Dates indicated in Figure 15-1 under, "Standard Service Milestones", are directly related to the Launch date specified in the current STS manifest and will be adjusted and tasks accomplished according to the current NASA approved flight date. Necessary changes to the activities caused by change to the flight date will be coordinated with the User through PIP change process.

16.0 REFERENCE DOCUMENTS

a) NASA OSF "Safety Policy and Requirements for Payloads Using the Space Transportation System," NHB 1700.7 (current issue).

b) Implementation Procedure for STS Payload Safety Requirements, JSC-13830.

c) STS/SYNCOM IV Interface Control Document TBD.

d) Shuttle Orbiter/Cargo Standard Interfaces, ICD 2-19001 current issue.

e) Space Transportation System Models Configuration Management/Control System and Standard Analyses for Payload Load Cycle, SD77-SH-0214, revision A dated December 1978.

f) KSC Launch Site Accommodation Handbook (K-STSM-14.1), current issue.

g) SPIDPO Change Control Requirements and Procedures Manual, JSC-13995, dated May 1978.

h) Shuttle/Payload Integration Activities Plan, JSC-14363

i) Space Shuttle System Payload Accommodations, JSC 07700 Vol XIV (current issue)

PRELIMINARY PRICE SUMMARY – PRICE PER LAUNCH – CURRENT YEAR DOLLAR ESTIMATES*

DATE PREPARED: 7 November 1979

PAYLOAD IDENTIFICATION: SYNCOM IV Initial Flight

TOTAL ESTIMATED PRICE: $ 10.050 + TBD (SM)* + USE FEE 1.633

STANDARD SHUTTLE PRICE: $ 9.618 (SM)*+USE FEE 1.521

OPTIONAL FLIGHT SYSTEM PRICE: $ N/A (SM)*+USE FEE

OPTIONAL SERVICE PRICE: $ .432 + TBD (SM)* + USE FEE .112

STANDARD SHUTTLE CHARGE INFORMATION

PAYLOAD CHARGEABLE WEIGHT (LBS) 17,260, LENGTH (IN) 190, INCLINATION 28.5°, CHARGE FACTOR .354

EARNEST MONEY DATE 16 March 79, PLANNED LAUNCH DATE 3-83, NUMBER OF FLIGHTS IN SERIES 1 + 4,

B. L. S. INDEX FACTOR* 1.487 AS OF 1 Oct 79 :: STANDARD $ 18.271 (75$M) PLUS USE FEES $ 4.298

OPTIONAL FLIGHT SYSTEM INFORMATION

DESCRIPTION:

N/A

PAYLOAD RELATED OPTIONAL SERVICE INFORMATION

OPTION DESCRIPTION	ESTIMATE	OPTION DESCRIPTION	ESTIMATE
1. MDM PF-2 Harnesses	TBD		
2. Design Support Loads Cycle	TBD		
3. Super Guppy transportation from LAX to KSC	.080M		
4. KSC Management and Support			
a) Facility use charge	.112M		
b) Optional Service Package (OSP)	.345M		
c) Delta to OSP	.007M		

*ESTIMATES SUBJECT TO ESCALATION ACCORDING TO THE BUREAU OF LABOR STATICS (B.L.S.) INDEX AS DEFINED IN THE NASA REIMBURSEMENT POLICIES NMI 8610.8 AND NMI 8610.9; USE FEES ARE NOT SUBJECT TO ESCALATION

!!!NOTICE!!! THESE ESTIMATES ARE IN CURRENT YEAR DOLLARS. THE BILLINGS WILL BE IN FUTURE VALUE DOLLARS!!

JSC Form 882 (Rev May 79) NASA-JSC

Figure 13-1.- Summary Cost Estimates.

PRELIMINARY PRICE SUMMARY – PRICE PER LAUNCH – CURRENT YEAR DOLLAR ESTIMATES*

DATE PREPARED: 7 November 1979

PAYLOAD IDENTIFICATION: SYNCOM IV — Follow On

TOTAL ESTIMATED PRICE: $ 9.937 + TBD(SM)* + USE FEE 1.633

STANDARD SHUTTLE PRICE: $ 9.618 (SM)* + USE FEE 1.521

OPTIONAL FLIGHT SYSTEM PRICE: $ N/A (SM)* + USE FEE

OPTIONAL SERVICE PRICE: $ .319 + TBD (SM)* + USE FEE .112

STANDARD SHUTTLE CHARGE INFORMATION

PAYLOAD CHARGEABLE WEIGHT (LBS) 17,260, LENGTH (IN) 190, INCLINATION 28.5°, CHARGE FACTOR .354
EARNEST MONEY DATE 16 March 79 PLANNED LAUNCH DATE TBD, NUMBER OF FLIGHTS IN SERIES 1 + 4,
B. L. S. INDEX FACTOR* 1.487 AS OF 1 Oct 79 :: STANDARD $ 18.271 (75$M) PLUS USE FEES $ 4.298

OPTIONAL FLIGHT SYSTEM INFORMATION

DESCRIPTION:

N/A

PAYLOAD RELATED OPTIONAL SERVICE INFORMATION

OPTION DESCRIPTION	ESTIMATE	OPTION DESCRIPTION	ESTIMATE
1. MDM PF-2 Harnesses	TBD		
2. Design Support Loads Cycle	N/A		
3. Super Guppy transportation from LAX to KSC	.080M		
4. KSC Management and Support			
a) Facility use charge	.112M		
b) Optional Service Package (OSP)	.232M		
c) Delta to OSP	.007M		

*ESTIMATES SUBJECT TO ESCALATION ACCORDING TO THE BUREAU OF LABOR STATICS (B.L.S.) INDEX AS DEFINED IN THE NASA REIMBURSEMENT POLICIES NMI 8610.8 AND NMI 8610.9; USE FEES ARE NOT SUBJECT TO ESCALATION
!!!NOTICE!!! THESE ESTIMATES ARE IN CURRENT YEAR DOLLARS. THE BILLINGS WILL BE IN FUTURE VALUE DOLLARS!!

JSC Form 692 (Rev May 79) NASA-JSC

Figure 13-1.- Summary Cost Estimates (concluded).

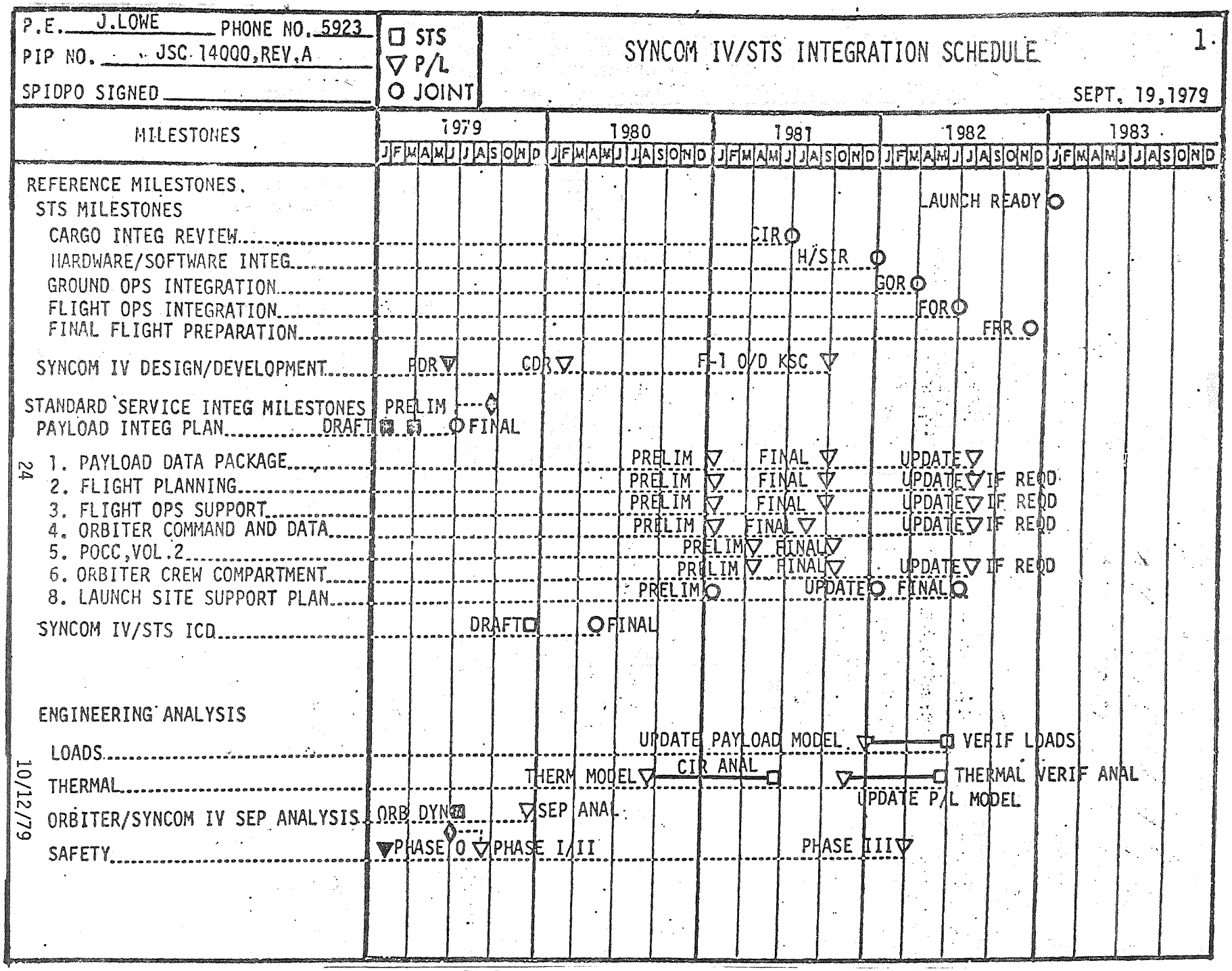

Figure 15-1.- SYNCOM IV/STS Integration Schedule.

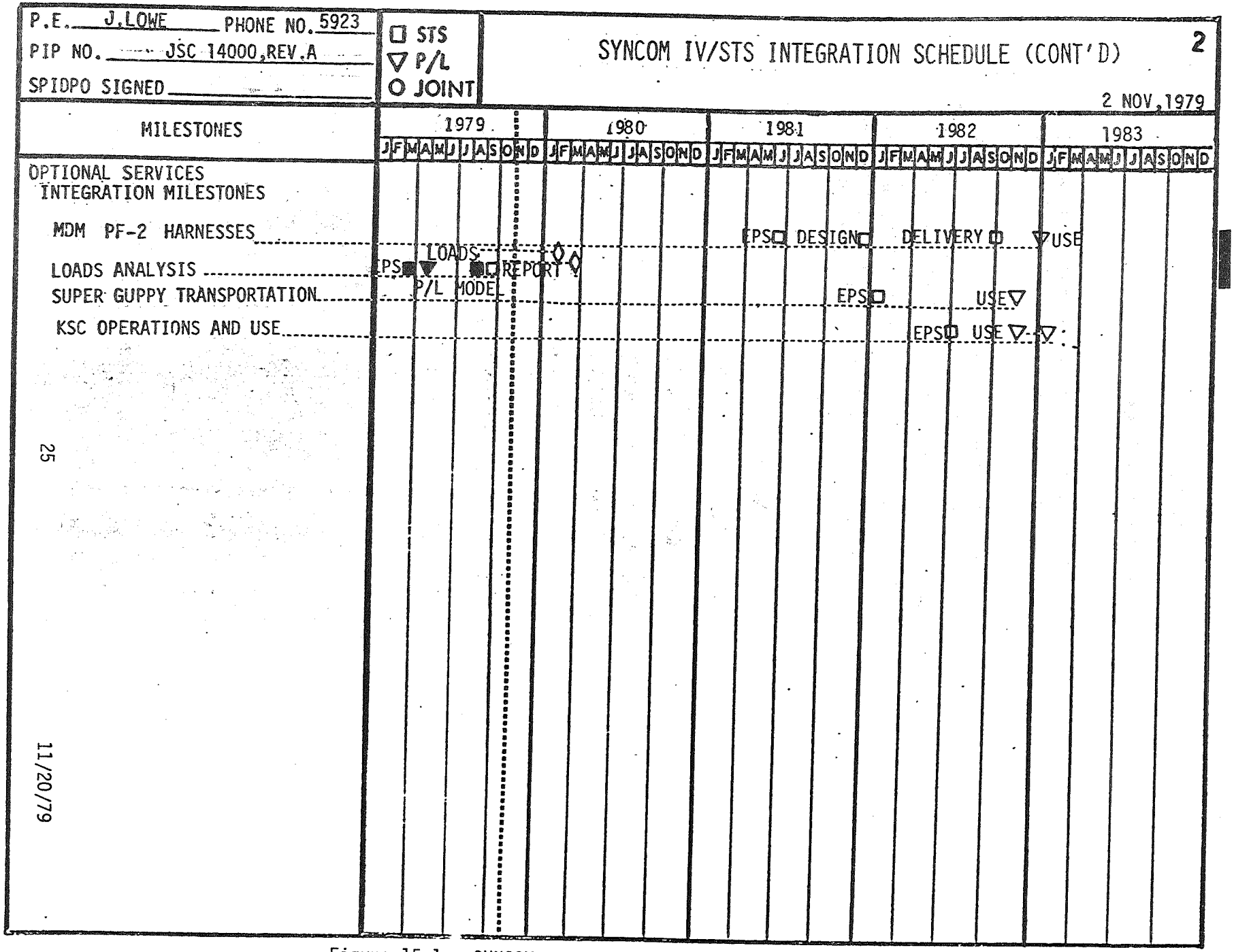
P.E. J.LOWE PHONE NO. 5923
PIP NO. JSC 14000,REV.A
SPIDPO SIGNED
STS
P/L
JOINT
SYNCOM IV/STS INTEGRATION SCHEDULE (CONT'D)
2
2 NOV,1979
MILESTONES
1979
1980
1981
1982
1983
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
OPTIONAL SERVICES
INTEGRATION MILESTONES
MDM PF-2 HARNESSES
EPS DESIGN DELIVERY USE
LOADS
LOADS ANALYSIS
EPS REPORT
P/L MODEL
SUPER GUPPY TRANSPORTATION
EPS USE
KSC OPERATIONS AND USE
EPS USE
25
11/20/79

Figure 15-1.- SYNCOM IV/STS Integration Schedule (concluded).

APPENDIX A

To Be Resolved items

1. Ref paragraph 4.3.1.2 Launch Window. STS requires that the capability exists to launch either near noon GMT or near midnight GMT for any given launch date.

   Syncom IV desires a near noon GMT launch between April 17 and September 20 and a near midnight GMT launch between October 17 and March 17. Remaining dates require a near noon or a near midnight GMT launch.

2. Ref paragraph 9.5 Aborted Missions. STS requires that HCSI be prepared to accept the payload at the contingency landing site after removal. HCSI agrees to supply the GSE but requests the payload be returned to the KSC launch site by the STS.

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STS AND SYNCOM
PAYLOAD INTEGRATION PLAN

LIST OF EFFECTIVE PAGES

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The current status of the document change pages is as shown below:

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PAYLOAD INTEGRATION PLAN

SPACE TRANSPORTATION SYSTEM

AND

SYNCOM IV

August 7, 1979

APPROVED:

NASA/JSC/SPIDPO

SYNCOM IV PROGRAM MANAGER

PREFACE

This Payload Integration Plan (PIP) represents the User to Space Transportation System (STS) agreement on the responsibilities and tasks which directly relate to the integration of the payload into the STS, and includes definitions of tasks which the STS considers as standard and optional services.

Signature of this document constitutes agreement on the scope of the work to be performed including the optional services, but it does not commit the payload to the reimbursement price and schedule of payment or the STS to the funding and implementation of the optional services. Upon completion of negotiations and signature of the Launch Services Agreement, or provision of required funding, the optional services identified will be implemented by the STS. The official commitment for the launch is reflected in the Launch Services Agreement. The launch date shown in this PIP is for planning purposes only.

Further understanding of the STS operations and the associated payload unique requirements may indicate the need for additions to or deletions from the optional services. This can be accommodated by amendment of the PIP and the Launch Services Agreement.

Issues which are yet to be resolved are labeled "TBR" in this PIP, and additional detail is documented in Appendix A. Information not at issue but which is yet to be determined is labeled "TBD."

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1.0 INTRODUCTION

The National Aeronautics and Space Administration (NASA), and Hughes Communications Services Inc. (HCSI) plan to launch and deploy in orbit several SYNCOM IV (S-IV) with the Space Transportation System (STS). A total of five S-IV spacecrafts are planned to be launched over a 2-year period.

For purposes of this Payload Integration Plan (PIP), the STS shall be represented by the NASA-Johnson Space Center (JSC) and the NASA-Kennedy Space Center (KSC). The SYNCOM IV shall be represented by Hughes Communications Services Inc. (HCSI).

This PIP and its subsequent revisions shall not provide a right or impose an obligation on the HCSI or NASA until the relevant Launch Services Agreement (LSA) and amendments are signed by an authorized representative of the HCSI and by NASA. This PIP is the document identified in TBD section of the LSA, between NASA and the HCSI dated TBD.

This plan provides the management roles and responsibilities, and a definition of the technical activities, interfaces, and schedule requirements to accomplish the integration, launch and deployment of the SYNCOM IV with the STS. All services to be furnished by NASA to the User under this PIP shall be furnished by NASA using its best efforts.

2.0 MANAGEMENT RESPONSIBILITIES

The responsibility for assuring the definition, control, implementation, and accomplishment of the activities identified in this document for the STS is vested with the Shuttle Payload Integration and Development Program Office (SPIDPO) at NASA-JSC and for S-IV with the HCSI.

2.1 Joint Responsibilities

The STS and HCSI will support the necessary integration activities, both analytical and physical, identified in this plan and according to the schedules contained in section 15. The STS and HCSI will staff the interface working groups with the technical personnel responsible for the accomplishment of the integration tasks. The interface working groups include management, structural/mechanical, avionics, thermal, flight planning, flight operations and ground operations.

2.1.1 Documentation.- The primary documentation to insure proper integration of the payload will consist of the PIP, the PIP annexes, and appropriate ICD's. These documents and associated changes will be jointly approved by STS and HCSI. Configuration control will be initiated upon signature approval. NASA/JSC will maintain configuration control of the above documentation in accordance with Change Control Requirements and Procedures Manual JSC 13995 with the exception of the Launch Site Support Plan Annex which will be maintained by KSC in accordance with (TBD) plan.

2.1.2 Reviews.- The following reviews will be implemented to assess the cargo implementation process as described in the Shuttle Payload Integration Activities Plan, JSC 14363:

a. Cargo Integration Review (CIR).

b. Integration Hardware/Software Review (IH/SR).

c. Flight Operations Review (FOR).

d. Ground Operation Review (GOR).

e. Flight Readiness Review (FRR).

2.2 STS Responsibilities

NASA/JSC is responsible for integration of the S-IV into the STS including analytical and physical integration, integrated flight design, integrated flight operations prior to deployment, and compatibility with other cargo elements which share the same flight.

NASA/KSC Payload Project Office is responsible for the STS launch and landing support, for agreed upon facilities and services required for integrated checkout, and for ground integration of the S-IV and STS.

2.3 Hughes Communications Services Inc. Responsibilities

The HCSI is responsible for the design, development, test, performance and safety of the S-IV flight spacecraft and airborne and ground support equipment to KSC, as well as providing support to the STS analytical and physical integration activities.

3.0 PAYLOAD DESCRIPTION

The S-IV program involves the design, fabrication, and test of a geosynchronous communications spacecraft and its cradle specifically designed for Space Shuttle launch. The spacecraft contains all propulsion systems necessary to attain geosynchronous equatorial orbit from the STS parking orbit (nominal 160 nautical miles circular altitude, 28.5^{o} inclination). The cradle provides the necessary structural tie between the STS and the satellite, and contains the necessary mechanisms to deploy the spacecraft from the STS.

The S-IV spacecraft configuration is shown in figure 3-1. The spacecraft with cradle is approximately 15 feet in diameter and will occupy a Shuttle bay length of approximately 15.3 ft.

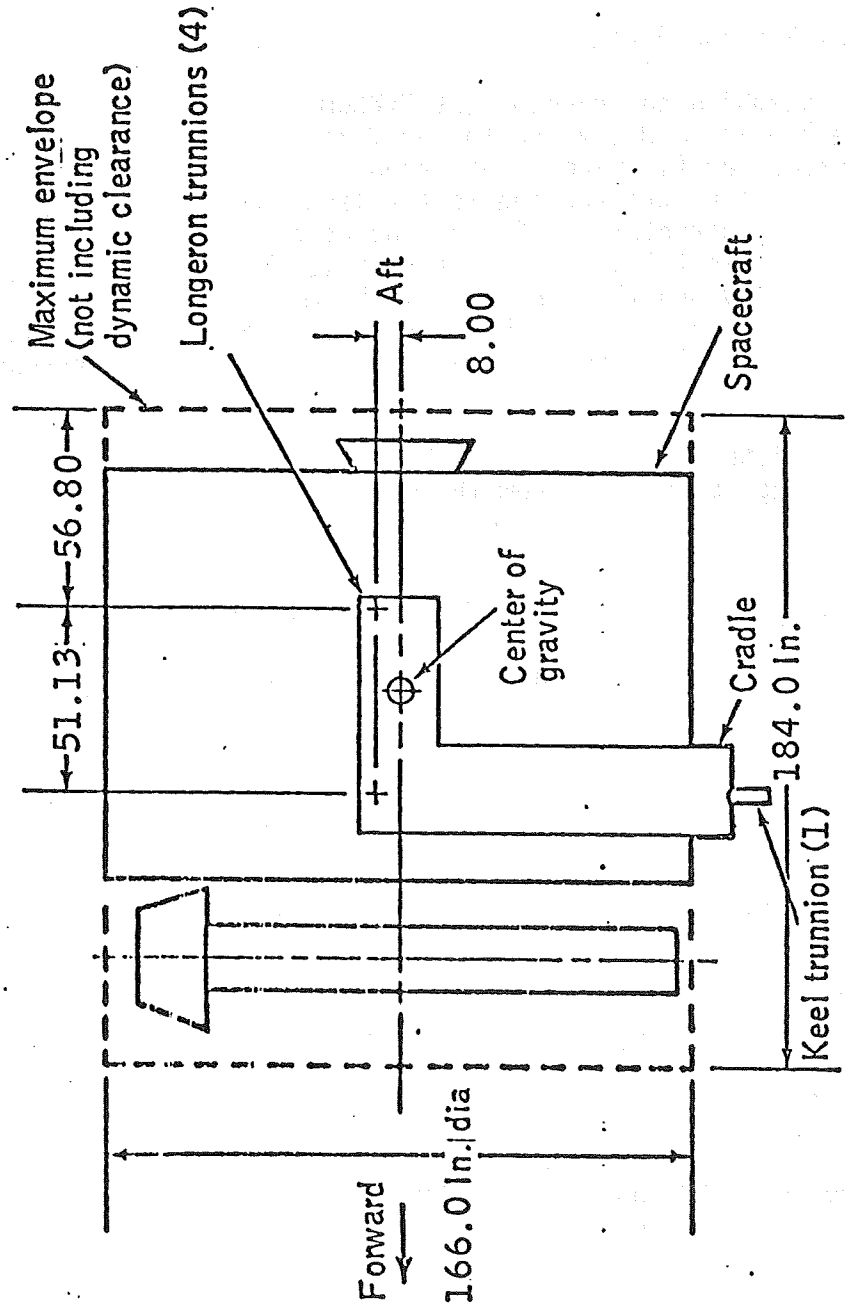

Figure 3.1.- Syncom IV envelope.

4.0 MISSION OPERATIONS

The flight operations summary requirements and constraints by flight phase are as delineated in subsequent paragraphs of this section.

4.1 Preliminary Mission Scenario

The completely assembled and checked out SYNCOM IV spacecraft and airborne support equipment will be delivered to the Vertical Processing Facility for cargo interface verification. The cargo will then be installed in the transportation canister, transported to the launch pad, and installed into the rotating service structure (RSS) for subsequent installation into the STS cargo bay. Once installed in the cargo bay, the electrical connections between the S-IV and the Orbiter will be made and the interfaces verified. Launch will be from the Kennedy Space Center (KSC), Florida. After reaching orbital altitude, the cargo bay doors will be opened and any required payload pre-deployment checkout activities will be initiated.

The crew will initiate deployment from the aft flight deck (AFD) control panel, and following separation from the Orbiter, the S-IV will become the operational responsibility of the HCSI.

4.2 Orbital Requirements and Payload Control Parameters

Orbital altitude: 160 n.mi., ± TBD n.mi. 3σ

Inclination: $28.5^{o} \pm 0.1^{o}$ (3σ)

Syncom IV control weights:

Spacecraft		15,450 lbs
Airborne support equipment*		1,800 lbs
Unique integration hardware*		10 lbs
	Total	17,260 lbs

*These items will remain onboard the STS after the spacecraft is deployed.

Maximum payload control length including dynamic and access clearances = 190 inches

The term "control weight" and "control length" as used in this PIP is the limit weight or length which the payload may not exceed without STS concurrence.

S-IV sequenced mass properties and configuration drawings will be provided by HCSI as part of Payload Data Package Annex.

4.3 Operational Requirements and Constraints

The following S-IV operational requirements and constraints will be used in the flight planning and implementation of the STS and S-IV flight.

4.3.1 Prelaunch.- Prior to cargo bay door closure on the pad, all S-IV RF transmitters will be turned off.

4.3.1.1 Launch Readiness: SYNCOM IV will be in its launch configuration when the cargo bay doors are closed. At this time the HCSI will provide the STS with launch readiness confirmation for the SYNCOM IV.

4.3.1.2 Launch Window: The Syncom IV launch window requirements are to be defined in terms of right ascension limits of the ascending or descending node of the Earth parking orbit. These requirements will be provided in the Flight Planning Annex.

Within these limits NASA will provide for one nominal deployment opportunity and plan for as many back up opportunities as possible within the constraints of flight duration and launch windows of the shared payload.

Two launch windows will be available, (one near noon GMT and one near midnight GMT) for any given calendar date. The launch window will be at least 20 minutes duration (Appendix A item I issues to be resolved).

4.3.2 Ascent.- Not Applicable

4.3.3 On-orbit.- The cargo bay doors should be assumed to be opened no sooner than 1 hour after launch and no later than 3 hours after launch. Cargo bay door opening shall preclude solar reflections on the payload. If the doors are not opened by 3 hours after launch, the Orbiter will return and landing will be completed by launch plus 6.5 hours. For abort descent and landing, the payload shall be designed so that the resulting thermal conditions present no hazard to the Orbiter or crew. For flight contingency landing sites, no ground purge capability of the cargo bay will exist.

4.3.3.1 Thermal Environment: The STS will normally be oriented with the cargo bay facing Earth (+ZLV) with multiple allowable excursions, deep space viewing (+ZSpace) and no more than 3 allowable excursions of solar viewing (+ZSolar) as shown in the following table. Also specified are the payload recovery times at +ZLV which allows repeat of these excursions prior to spacecraft deployment. Payload recovery times at +ZLV required to stabilize SYNCOM IV temperatures prior to spacecraft deployment are TBD.

Table 4-1

β ANGLE < 60° ATTITUDE REQUIREMENT

Attitude	Required time	Payload recovery time @ +ZLV
+ZLV	Continuous	N/A
+Z Solar*	30 minutes	TBD
+Z Space	90 minutes	TBD

*Includes all sun angles which result in illumination on the payload.

The following constraints do not apply when the Orbiter is in the +ZLV attitude.

Should the SYNCOM IV spacecraft extend forward of Station X_0 = 1000 the spacecraft may experience unacceptably high temperatures due to direct sun plus solar reflections from the raised forward Orbiter door radiators. This condition shall be avoided by incorporating any one of the following operational constraints during periods of sun exposure of the cargo bay:

1) Restrict sun angles into the cargo bay to be within 30 degrees of the Orbiter +x or -x axes.

2) Provide an Orbiter roll rate of at least 8 RPH.

3) Lower the forward radiators to the stowed position in the door.

Airborne support equipment remaining in the cargo bay after deployment of the payload shall be compatible with the Orbiter attitude capability as defined in paragraph 6.1.1.2 of ICD 2-19001. In the event of failure to deploy the SYNCOM IV due to STS problem(s) the thermal attitude constraints of Table 4-1 shall apply. In the event of failure to deploy the SYNCOM IV due to a SYNCOM IV problem the STS attitudes will be inhibited by payload safety constraints, if the attitude constraints of Table 4-1 cannot be maintained. The constraints will be defined by HCSI in terms of solar and deep space exposure times in the mission rules section of the Flight Operations Support Annex.

4.3.3.2 Command/Telemetry: The SYNCOM IV spacecraft has no downlink telemetry or up-link command interfaces with the STS. No on-orbit attached RF checkout or S-IV ground station passes are required. The cradle command and data interface is discussed in Sections 5.3 and 5.4.

4.3.3.3 Deployment Opportunities: SYNCOM IV requires deployment 45 minutes prior to the perigee motor firing. Deployment longitude is dependent on time of year and midnight/noon GMT STS lift-off. The nominal deployment shall occur consistent with the longitude crossings in Table 4-2.

4.3.3.4 STS/SYNCOM IV Deployment Timing and Pointing: The Orbiter will be in a retrograde attitude and will be oriented within 2.1 degrees (3σ)

of the payload specified inertial deployment attitude as referenced to the plane of the payload longeron/cradle interface. The STS will deploy the SYNCOM IV within ±2 seconds (3σ) of the specified deployment time.

The accuracy of the knowledge of the orbit parameters will be within those defined in table 4.3.

4.3.3.5 STS/SYNCOM IV Separation: The SYNCOM IV-provided linear separation rate from the STS shall be approximately 1.4 feet per second and the perigee motor ignition shall not occur earlier than 45 minutes after deployment. The payload attitude control system shall not be activated prior to a separation distance of 200 feet.

The standard Orbiter separation maneuver will be designed to minimize RCS plume impingement on the payload, consistent with achieving a safe separation distance.

The orbiter RCS shall be inhibited from 3 seconds prior to deployment until 15 seconds after deployment.

4.3.3.6 Photographic Coverage: Photographic coverage of the spacecraft deployment and separation from the Orbiter will be accomplished by the flight crew.

4.3.3.7 The Orbiter Ku Band system shall not be activated until the SYNCOM IV spacecraft has reached 1 n.mi. from the orbiter.

4.3.3.8 The manipulator positioning mechanism shall be deployed to the outboard location prior to payload deployment.

5.0 SYNCOM IV-TO-STS INTERFACES

The STS mechanical, electrical, avionics, and environmental interfaces are defined in ICD 2-19001 with which the SYNCOM IV spacecraft must be compatible. A unique Interface Control Document (ICD) will be generated by STS to define and control the S-IV unique interface requirements. The cargo bay electrical interfaces, except for the RF interface, are physically located above the Z_0 410 station, at or near the trunnion interface. The specific location of the electrical interfaces are TBD.

5.1 Structural/Mechanical Interfaces

The structural/mechanical interface between the S-IV and the STS consists of four longeron trunnions and one keel trunnion that will attach to the STS-provided longeron and keel attach fittings. The forward longeron fittings are primary and the aft fittings are stabilizer fittings; all longeron fittings are passive.

TABLE 4.2

INJECTION OPPORTUNITIES AND ASSOCIATED

LONGITUDES FOR PERIGEE MOTOR FIRE

TIME	INJECTION OPPORTUNITY*	LONGITUDE
1st Day	15	167.8°W
	17	169.1°E
	21	122.9°E
2nd Day	47	177.5°W
	49	159.4°E
	53	113.2°E
3rd Day	77	164.1°W
	79	172.8°E
	95	12.0°W

*Descending node based on Midnight GMT STS liftoff.

TABLE 4.2 - Continued

TIME	INJECTION OPPORTUNITY**	LONGITUDE
1st Day	TBD	TBD
	TBD	TBD
	TBD	TBD
2nd Day	TBD	TBD
	TBD	TBD
	TBD	TBD
3rd Day	TBD	TBD
	TBD	TBD
	TBD	TBD

**Ascending node based on Noon GMT STS liftoff.

TABLE 4-3 ORBITER STATE VECTOR UNCERTAINTY AT DEPLOYMENT (3σ)

POSITION, ft			VELOCITY, fps		
RADIAL	INTRACK	CROSS TRACK	RADIAL	INTRACK	CROSS TRACK
4,921	34,450	4,921	38.4	5.9	9.8

5.2 Cable Interfaces

The S-IV will use one section of the standard AFD and payload harnesses in accordance with the mixed user allocation section of JSC 07700 Vol. XIV and as an optional service STS will provide harnesses for 6 additional MDM analog signals to the payload.

Specific wiring pin function asignments will be defined in the STS/SYNCOM IV ICD.

5.3 Display and Control Interfaces

Display and control functions are accomplished using the following crew-controlled equipment:

1 Section of the Standard Switch Panel

Assignment of functions and nomenclature for the switch panel functions are to be defined in the Orbiter Crew Compartment Annex to this PIP.

Requirements for display and control functions accomplished using the Orbiter general purpose computer/keyboard/CRT combination are to be defined by HCSI in the Command and Data Annex to the PIP.

5.4 Electrical Power Interfaces

For SYNCOM IV ground operations prior to installation in the STS, power will be supplied to the SYNCOM IV using HCSI-provided electrical ground support equipment. During the STS/SYNCOM IV ground and flight-mated operations, power will be supplied by the STS as defined in the following paragraphs.

SYNCOM IV shall provide means for cradle electronics power activation/ deactivation via crew control and for fusing and or circuit breaker protection of its power circuits from the Orbiter.

Electrical power interface requirements at the payload interface for the minimum expected voltage are as follows:

Power Source	Prelaunch	Launch	Payload deployment Prior To	Payload deployment After
a) Orbiter cargo bay bus	2000W(3)	N/A	2000W(1)	330W(2)
b) Orbiter AFD D.C. bus	100W(3)	N/A	100W	100W

Note: 1. Required primarily for earth and deep space facing.

Note: 2. Required for deep space facing with only 30 watts required for earth facing.

Note: 3. During prelaunch payload interface verification only prior to cargo bay doors closeout.

The specific power profile will be defined by HCSI in the Flight Planning Annex.

5.5 Command Interfaces

The command interfaces are:

Commands Interface/Source	Prelaunch	Launch	Payload Deployment Prior To	Payload Deployment After
a. Hardwire from Standard Switch Panel	X	N/A	X	X
b. Hardwire from MDM	X	N/A	X	N/A

5.6 Telemetry and Data Interfaces

There is no telemetry interface of the SYNCOM IV to the STS. Data interfaces are as follows.

Data Interface/Route	Prelaunch	Launch	Payload deployment Prior To	Payload deployment After	Landing
a) Hardwire to Standard Switch Panel	X	N/A	X	X	N/A
b) SYNCOM IV to MDM 10 standard (2 analog and 8 digital) + 6 optional analog parameters	X	N/A	X	X	N/A

Engineering characteristics will be defined in the SYNCOM IV/STS unique ICD and the data parameters will be defined by the HCSI in the Command and Data Annex.

The phased sequence of operational usage of the data systems will be specified in the Flight Operations Support Annex.

5.7 Fluid Interfaces - N/A

5.8 Orbiter GPC Software Services

The SYNCOM IV software services are standard and the measurement requirements will be defined in the command and data annex. There are no requirements for nonstandard software.

6.0 ENVIRONMENTAL ANALYSIS AND INTERFACES

Standard Shuttle/payload natural and induced environmental interfaces including structural loads, thermal, contamination, shock, vibration and acoustics are contained in the Shuttle Orbiter/Cargo Standard Interfaces, ICD 2-19001.

Environmental interface analyses will be conducted to determine physical and functional interface compatibility of the SYNCOM IV and STS. The specific analyses are described in the following paragraphs.

6.1 Structural Loads and Deflections

Preliminary design guidelines for the payload are provided in ICD 2-19001. These guidelines correspond to the Shuttle loading environments and are recommended as minimum conditions to which the payload should develop its preliminary design. Subsequent design shall be based upon coupled dynamic and quasi-static analyses performed using updated payload and Shuttle models. The SYNCOM IV is responsible for assuring that the payload is designed to be compatible with the Shuttle environments resulting from these analyses and any subsequent updates, and the payload design must accommodate any cargo bay location within Orbiter attachment and load limitations. The payload is also responsible for assuring that the interface forces and deflections (including thermal effects) do not exceed the allowables in ICD 2-19001.

The schedule for anticipated Shuttle model and forcing function updates will be provided to the payload. The payload is responsible for applying appropriate conservatism to the loads to account for anticipated model and forcing function updates. The STS will advise the payload regarding the status of Shuttle activities which could effect payload loads; however, the responsibility for payload compatibility with the final flight loads remains with the payload.

For the SYNCOM IV, one design support loads cycle will be performed by the STS as an optional service documented in a payload/STS loads report, and provided to HCSI. This loads report will be discussed by the joint working group to assure understanding and agreement, and the report will be referenced in the unique ICD. The STS will subsequently perform a verification loads cycle for the final manifest, as a standard service, using a final, verified payload model provided by HCSI. The model deliveries and analyses will be in accordance with the Section 15 schedule. All models, analyses and reports will be in accordance with SD77-SH-0214.

The results of the verification loads cycle will be used by the STS to assure that the interface load conditions are within the Orbiter capability. The HCSI is responsible for verifying the payload compatibility with these loads and for verifying that the dynamic envelope (including thermal effects) does not exceed the allowable limit as specified in ICD 2-19001.

6.2 Thermal Environments and Interfaces

The SYNCOM IV is responsible for the design and analysis of the payload to assure compliance with the thermal and attitude constraints defined in section 4.0. The STS will furnish Orbiter thermal models to HCSI. Results of supporting design analysis accomplished by the HCSI will be documented in a SYNCOM IV/STS thermal report and provided to the STS. This report will be discussed by the joint working groups to assure understanding and agreement. Thermal models and updates including critical nodes and temperature limits for these nodes shall be furnished by the HCSI to STS. STS will then perform an integrated cargo thermal analysis consistent with jointly agreed upon flight conditions to support the cargo integration review. A second integrated thermal analysis will be performed as part of the flight verification cycle. The schedule for furnishing the various SYNCOM IV thermal models and results of the integrated analyses are contained in section 15. All models, analyses, and reports will be in accordance with document JSC 14686. The results of the verification thermal analysis will be used by the STS to assure that the resulting thermal environment is compatible with the Orbiter and other cargo elements.

The HCSI is responsible for verifying the payload's compatibility with this environment.

6.3 EMI/EMC

The HCSI is responsible for assuring that the SYNCOM IV interfaces meets the induced EMI environment and the entire SYNCOM IV complies with the radiated requirements defined in ICD 2-19001. (Note: Payload compatibility with the Orbiter Ku-band radiation levels is not required.) The specific characteristics of the payload radiation sources will be defined in the Payload Data Package Annex according to the schedule defined in section 15. The STS will perform an intentional-radiator RF interference assessment for mutual compatibility as a standard service. However, the payload retains the responsibility for assuring that his payload operates properly in the anticipated environment. Payload intentional transmitter

radiated levels outside the payload envelope incident on other cargo elements within the cargo bay shall be limited to those levels specified in Figure 10.7.3.2-3 in ICD 2-19001 at S-band frequencies and below and not to exceed S-band levels above S-band frequencies.

6.4 Contamination

The HCSI is responsible for assuring that the payload is compatible with the induced contamination environment and complies with the outgassing requirements as defined in ICD 2-19001.

6.5 Shock, Vibration and Acoustic Environments

The SYNCOM IV is responsible for compatibility with the STS induced shock, vibration and acoustic environments defined in ICD 2-19001.

6.6 Ground Environmental Requirements

Load factors for ground handling and transportation hardware for the SYNCOM IV shall not exceed those specified in the Launch Site Accommodations Handbook, K-STSM-14.1.

Environmental conditions and cleanliness levels of SAEF-2, Vertical Processing Facility, canister and the Rotating Service Structure are also defined in the Launch Site Accommodations Handbook, K-STS-14.1.

After cargo bay door closure until launch conditioned air/GN_2 will be provided for cargo bay purge between 60-70^{o} F.

6.7 Orbiter/SYNCOM IV Separation Analysis

The S-IV Program shall conduct an analysis of separation dynamics, including worst case dispersions, of SYNCOM IV separation from the Orbiter. The STS will provide the Orbiter initial conditions and geometry, in support of the analysis. The analytical results will be provided by S-IV Program to the STS according to the schedule in section 15.

7.0 INTEGRATION HARDWARE AND SERVICES

The responsibilities for the integration hardware are defined in the following paragraphs.

7.1 STS Provided Hardware

a) STS will provide the four passive longeron and one active keel attach fittings.

b) STS will provide the cargo bay wire harnesses, including power, from the respective STS power and signal interfaces to the SYNCOM IV cradle interface.

c) STS will provide a Standard Switch Panel in the Aft Flight Deck (AFD).

d) STS will provide as an optional service harnesses for 6 MDM analog channels.

e) STS will provide as an optional service air transportation from Los Angeles to KSC for the Syncom IV payload.

7.2 Payload-Provided Hardware

SYNCOM IV will provide the payload half of the cradle electrical connectors.

8.0 FLIGHT OPERATIONS

This section defines the flight design, flight activity planning, flight crew and flight controller training and flight operations support activities required for SYNCOM IV/STS integration.

8.1 Flight Design

The STS will be responsible for performing integrated mission analysis from lift-off until SYNCOM IV separation. The constraints for flight design are defined in Section 4. SYNCOM IV will provide information to support the analysis in the Flight Planning Annex. The SYNCOM IV program will be responsible for the detached SYNCOM IV orbital flight requirements.

8.2 Flight Activity Planning

8.2.1 Crew Activity Plan.- The STS will be responsible for all crew activity plans and will develop an integrated summary STS/SYNCOM IV crew activity plan to support the flight. Included in the plan will be the HCSI supplied payload sequence of events. The HCSI will provide this sequence of events as part of the Flight Planning Annex.

8.2.2 Payload Operating Procedures.- HCSI is responsible for the development and verification of payload operating procedures. The payload operating procedures are provided by HCSI and transmitted to the STS via the Flight Operations Support Annnex of the PIP. These procedures will be used by the STS to generate the integrated STS/payload procedures.

8.3 Training

The STS will be responsible for providing the crew training plans and crew training required for the STS/SYNCOM IV flight. The SYNCOM IV program is

responsible for providing a crew briefing for payload familiarization and for providing configuration data to support the above training.

8.4 Flight Operations Control

The STS will be responsible for integration of flight operations until the SYNCOM IV is a safe distance from the Orbiter. The STS flight control operations will be conducted from the NASA-JSC Mission Control Center (MCC) using the Space-flight Tracking and Data Network (STDN) network. The HCSI flight operations and control will be conducted from SYNCOM IV Misson Control Center at El Segundo, California. HCSI is responsible for all SYNCOM IV operations after the Orbiter is out of the SYNCOM IV hazard envelope. The STS shall provide the SYNCOM IV Mission Control Center with the preflight predicted SYNCOM IV deployment parameters and the realtime best estimate deployment parameters consisting of the Orbiter state vector, attitude, attitude rate and time. The realtime best estimate deployment parameters will be passed to the SYNCOM IV Mission Control Center as soon as possible after SYNCOM IV deployment. The basic plan, timelines and agreements for these operations including necessary procedures will be identified in the Flight Operations Support Annex. HCSI will provide payload representative(s) at the JSC MCC to support SYNCOM IV flight operations.

8.5 Command and Control Support

Communications interface between the MCC and the SYNCOM IV POCC will be defined in the POCC Annex, Volume 2, and are summarized as follows:

a. Provide voice interface between the MCC and the SYNCOM IV POCC.

b. Provide a TTY/Facsimile hard copy interface to the SYNCOM IV POCC for the realtime best estimate SYNCOM IV deployment parameters.

9.0 LAUNCH AND LANDING SITE ACTIVITIES AND SUPPORT

As stated in paragraph 2.2, the Kennedy Space Center (KSC) is responsible for the launch and landing activities and support for SYNCOM IV. The KSC Launch Site Support Manager (LSSM) assigned to SYNCOM IV will receive and coordinate launch and landing requirements and provide a formal KSC response in the form of the Launch Site Support Plan (LSSP), which is Annex 8 to this PIP.

The SYNCOM IV Program will retain prime responsibility for test, checkout, servicing operations, etc. of the payload while in the Payload Processing Facility (SAEF-2). All integrated activities will be the responsibility of the appropriate STS organization.

Launch and landing site activities are divided into two broad categories: (1) Pre-Vertical Processing Facility (VPF) activities where the payload is received and processed at the launch site and (2) VPF and subsequent on-line activities wherein the payload becomes part of the total cargo for flight.

SYNCOM IV will be provided support while at the launch site under an Optional Service Package (OSP). The services provided in the OSP can be found in the Launch Site Accommodations Handbook. Those SYNCOM IV requirements which are beyond the scope of the OSP are identified in the following applicable subsections, and their estimated prices together with the price of the OSP appears in the Summary Pricing Sheet.

For VPF and subsequent online activities, SYNCOM IV support is included in the price per flight as determined from the charge factor, except for those requirements which cause serial time impacts to the VPF and online flows. SYNCOM IV serial impact requirements are identified in the following applicable subsections, and their estimated price are contained in the Summary Pricing Sheet.

The above described method of support will be consistent for each SYNCOM IV launched assuming the payload requirements remain the same. There will be a reduction in the OSP's for the follow-on flights in the area of launch site management since a portion of that service will be duplicated.

9.1 Pre-VPF Spacecraft Activities

Pre-VPF spacecraft related activities involve planned operations at the Cape Canaveral AFS Skid Strip, the Liquid Propellant Area, and the Payload Processing Facility (PPF), as well as the necessary support and transportation within, to and from those areas.

9.1.1 Spacecraft, GSE, and Perigee Kick Motor Arrivals.- The spacecraft and GSE will arrive at the CCAFS skid strip via the Super Guppy contracted aircraft. KSC will provide the personnel and equipment to support the offloading of the spacecraft and GSE from the aircraft and transporting and offloading them into the Payload Processing Facility (PPF) and the VPF. The aircraft will be provided crash and fire support and normal turnaround service for takeoff and landing.

9.1.2 Payload Processing Facility (PPF).- A PPF (SAEF-2 is planned) will be scheduled as a processing and control center for SYNCOM IV from payload arrival through launch. SYNCOM IV will have exclusive use of the airlock, the South high-bay cleanroom and its adjacent systems test area, the East cell, and office space on the first and second floors of the building. The building is equipped with administrative telephones, paging systems, operation communications nets, data lines, and RF links to offsite facilities, to mention but a few of the existing resources.

For hazardous processing the spacecraft will remain in the SAEF-2 where the approximately 8000 lb solid perigee kick motor will be installed, the liquid apogee motor system will be filled with approximately 1600 lbs of MMH and approximately 2600 lbs of N2O4, the helium tank will be serviced, the reaction control system will be filled with approximately 370 lbs of hydrazine, and ordnance will be installed. Following servicing the propellant tanks will be pressurized to flight pressure and monitored for pressure decay and propellant leakage. The spacecraft will then be prepared for transport to the VPF for vertical cargo integration.

SYNCOM IV requires that a security guard be provided on off-duty hours and weekends when the test team is not working. These requirements are not included in the OSP, and the additional price can be found in the Summary Pricing Sheet.

9.1.3 Solid Propellant/Liquid Propellant Areas.- Prior to the loading activities, KSC will provide space in the Solid Propellant Storage Area and the Liquid Propellant Storage Area for the Minuteman III motor and for sufficient quantities of hydrazine, N2O4, and MMH (which may be supplied at an optional charge). KSC will provide transportation and labor for movement of the Minuteman III motor and liquid propellants as required.

9.2 VPF and Online Activities

The payload activities in the VPF, RSS, and Orbiter involve sequentially CITE tests, RSS operations, and operations within the Orbiter itself.

9.2.1 Vertical Payload Integration.- When the transporter carrying the SYNCOM IV enters the Vertical Processing Facility Airlock, it undergoes cleaning prior to entering the CITE workstand area. The payload is then hoisted or inserted into the appropriate position in the workstand according to the vertical cargo manifest, and systems testing and interface verification testing are conducted as required. The following operations shall be performed in this facility:

1. CITE Testing (1 KBS data line to PPF)

2. Final Readiness Test

When all the interface verification tests have been completed, the total integrated cargo is placed in the KSC payload (vertical) canister for transportation to the Pad (RSS).

9.3 Pad Operations

The vertical canister will be transported to the launch pad with the full manifest of vertically processed payloads. The canister will be hoisted into position, and the payloads will be extracted by the Payload Ground Handling Mechanism (PGHM) and retracted into the Rotating Service Structure (RSS). SYNCOM IV has requested time in the RSS for readiness testing and battery charging, which will be priced as an optional service in the Summary Pricing Sheet if they cannot be scheduled without impacting the Orbiter timeline. After the mobile launcher is hard-down on the pad, the RSS will rotate into position, and the payloads will be inserted into the Orbiter cargo bay. Payload installation and subsequent payload-to-Orbiter interface verification tests and closeout procedures will be accomplished. Orbiter bus power will be available after payload installation for payload functions as required. Just prior to Orbiter cargo bay door closing will be the last time that SYNCOM IV may be physically accessed before liftoff. Prelaunch control and monitoring of spacecraft functions via 1 kbps line will be provided by electrical ground support equipment in the PPF. At liftoff, all control functions are transferred to JSC MCC.

9.3.1 Launch.- During the launch countdown and for up to 2 days after liftoff, SYNCOM IV will be provided the use of four communications consoles located in the Mission Director's Center of Building AE for the Mission Manager and his advisors.

9.4 Postflight Processing

After landing at the Orbiter Landing Facility (OLF), the Orbiter is towed to the Orbiter Processing Facility (OPF) for deservicing/safing operations. The SYNCOM IV cradle is then removed horizontally from the Orbiter cargo bay and returned to HCSI.

9.5 Aborted Missions

If an aborted flight lands at the KSC Orbiter Landing Facility (OLF), it will be handled the same as in Section 9.4 above.

In the event that an aborted flight lands at the secondary or contingency landing site HCSI should be prepared to accept the payload at the landing site after removal from the cargo bay due to the limited ferry capability of the Shuttle Carrier Aircraft. If the cargo is within the ferry capability and associated safety requirements and is compatible with associated environments it will be returned to KSC in the Orbiter cargo bay. Reference Appendix A Item 2 Issues to be Resolved.

10.0 SAFETY

The HCSI is responsible for assuring that the SYNCOM IV, its ASE, and its GSE (ground support equipment) are safe. The SYNCOM IV and GSE shall be designed to comply with the requirements of NASA document NHB 1700.7 "Safety Policy and Requirements for Payloads Using the Space Transportation System." To assess compliance with the safety requirements a maximum of four safety reviews for the payload, GSE, and ground operations safety will be conducted by the STS in accordance with JSC 13830, "Implementation Procedure for STS Payload Safety Requirements," undated. The GSE and ground operations safety reviews will be coordinated/scheduled by the KSC/LSSM and may be held in conjunction with the flight safety reviews or ground operations meetings.

The safety documentation required to support each safety review will be provided to the appropriate NASA organization (ground OPS-KSC/LSSM; FLT OPS-JSC) by the HCSI 30 days prior to the scheduled safety review. The results of the safety reviews and assessments will be the safety certification of the SYNCOM IV and GSE by HCSI prior to delivery and start of processing, and installation in the Orbiter cargo bay. The HCSI will submit a flight readiness statement for the SYNCOM IV at the flight readiness review.

11.0 INTERFACE VERIFICATION

The payload is responsible for verifying compatibility with the interfaces and environments specified in the PIP and applicable ICD's. The non-safety associated interface verification requirements and planning will be negotiated and concurred in by the STS and HCSI. It is anticipated that this interface verification will be accomplished within the scope of normal test, checkout and integration flow of the SYNCOM IV spacecraft. Included within the flow at VPF is a Cargo Integration Test to verify pre-installation electrical and mechanical compatibility with the STS. The interface verification requirements are specified in Volume XIV, PIV 01.

12.0 POSTFLIGHT DATA REQUIREMENTS

Copies of the deployment photography will be provided.

13.0 OPTIONAL SERVICES

Planning and budget estimates of reimbursements for the payload transportation requirements and the above optional services are displayed in the STS Summary Price Sheet, figure 13-1. These estimates are intended to provide preliminary information on the assumed level of cost to be borne by HCSI and will change through more detailed definition and joint negotiations. The estimates are stated in current year dollars and the use of these estimates for planning purposes should be adjusted for inflation. The final estimates for Standard Shuttle Services and Optional Flight System Services will be jointly negotiated between NASA Headquarters and the HCSI in the Launch Services Agreement. Immediately prior to the initiation of the individual optional service, the performing NASA organization and HCSI will jointly define the tasks and negotiate the final firm price on a firm price sheet according to the section 15 schedule for the optional service.

1. Reference Section 5.2 and 7.1d - The STS will provide harnesses for 6 additional MDM analog channels.

2. Reference Section 6.1 - The STS will perform one Design Support Loads cycle documented in a SYNCOM IV/STS Loads Report and provide to HCSI.

3. Reference Section 7.1e - The STS will provide Super Guppy air transportation for the SYNCOM IV from Los Angeles, Calif. to KSC Florida.

4. Reference Section 9.0 - The off line facilities use charges and launch site support management and services are provided as an optional services.

14.0 PIP ANNEXES

As identified in other section of the document, the following annexes are required:

1. Payload Data Package

2. Flight Planning

3. Flight Operations Support

4. Orbiter Command and Data

5. POCC Volume 2

6. Orbiter Crew Compartment

8. Launch Site Support Plan

15.0 SCHEDULE

The attached schedule, figure 15-1, provides a summary of the various technical areas requiring data exchange and/or products in support of the SYNCOM IV/STS integration activities.

The data indicated in Figure 15-1 under, "Reference Milestones", are included for information only and are controlled by the STS or User organization.

Dates indicated in Figure 15-1 under, "Standard Service Milestones", are directly related to the Launch date specified in the current STS manifest and will be adjusted and tasks accomplished according to the current NASA approved flight date. Necessary changes to the activities caused by change to the flight date will be coordinated with the User through PIP change process.

16.0 REFERENCE DOCUMENTS

a) NASA OSF "Safety Policy and Requirements for Payloads Using the Space Transportation System," NHB 1700.7 (current issue).

b) Implementation Procedure for STS Payload Safety Requirements, JSC-13830.

c) STS/SYNCOM IV Interface Control Document TBD.

d) Shuttle Orbiter/Cargo Standard Interfaces, ICD 2-19001 current issue.

e) Space Transportation System Models Configuration Management/Control System and Standard Analyses for Payload Load Cycle, SD77-SH-0214, revision A dated December 1978.

f) KSC Launch Site Accommodation Handbook (K-STSM-14.1), current issue.

g) SPIDPO Change Control Requirements and Procedures Manual, JSC-13995, dated May 1978.

h) Shuttle/Payload Integration Activities Plan, JSC-14363

i) Space Shuttle System Payload Accommodations, JSC 07700 Vol XIV (current issue)

PRELIMINARY PRICE SUMMARY – PRICE PER LAUNCH – CURRENT YEAR DOLLAR ESTIMATES*

DATE PREPARED: 7 August 1979

PAYLOAD IDENTIFICATION: SYNCOM IV Initial Flight

TOTAL ESTIMATED PRICE: $9.855 USE (SM)* + FEE 1.633

STANDARD SHUTTLE PRICE: $ 9.281 USE (SM)*+FEE 1.521

OPTIONAL FLIGHT SYSTEM PRICE: $ NA USE (SM)*+FEE

OPTIONAL SERVICE PRICE: $ .574 USE (SM)* + FEE .112

STANDARD SHUTTLE CHARGE INFORMATION

PAYLOAD CHARGEABLE WEIGHT (LBS) 17,260, LENGTH (IN) 190, INCLINATION 28.5°, CHARGE FACTOR .354

EARNEST MONEY DATE 16 March 79 PLANNED LAUNCH DATE 3/81, NUMBER OF FLIGHTS IN SERIES 1 + 4,

B. L. S. INDEX FACTOR* 1.435 AS OF 1 April 79:: STANDARD $ 18.271 (75SM) PLUS USE FEES $ 4.298

OPTIONAL FLIGHT SYSTEM INFORMATION

DESCRIPTION:

N/A

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PAYLOAD RELATED OPTIONAL SERVICE INFORMATION

OPTION DESCRIPTION	ESTIMATE	OPTION DESCRIPTION	ESTIMATE
1. Analog MDM Harnesses	.017M		
2. Design Support Loads Cycle	.125M		
3. Super Guppy transportation from LAX to KSC	.080M		
4. KSC Management & Support			
a) Facility use charge	.112M		
b) Optional Service Package (OSP)	.345M		
c) Delta to OSP	.007M		

10/12/79

*ESTIMATES SUBJECT TO ESCALATION ACCORDING TO THE BUREAU OF LABOR STATICS (B.L.S.) INDEX AS DEFINED IN THE NASA REIMBURSEMENT POLICIES NMI 8610.8 AND NMI 8610.9; USE FEES ARE NOT SUBJECT TO ESCALATION

!!!NOTICE!!! THESE ESTIMATES ARE IN CURRENT YEAR DOLLARS. THE BILLINGS WILL BE IN FUTURE VALUE DOLLARS!!

JSC Form 692 (Rev May 79) NASA-JSC

Figure 13-1.- Summary Cost Estimates.

PRELIMINARY PRICE SUMMARY – PRICE PER LAUNCH – CURRENT YEAR DOLLAR ESTIMATES*

DATE PREPARED: 7 August 1979

PAYLOAD IDENTIFICATION: SYNCOM IV — Follow On

TOTAL ESTIMATED PRICE: $ 9.601 USE (SM)* + FEE 1.633

STANDARD SHUTTLE PRICE: $ 9.281 USE (SM)*+FEE 1.521

OPTIONAL FLIGHT SYSTEM PRICE: $ N/A USE (SM)*+FEE

OPTIONAL SERVICE PRICE: $ .320 USE (SM)* + FEE .112

STANDARD SHUTTLE CHARGE INFORMATION

PAYLOAD CHARGEABLE WEIGHT (LBS) 17,260, LENGTH (IN) 190, INCLINATION 28.5°, CHARGE FACTOR .354

EARNEST MONEY DATE 16 March 79 PLANNED LAUNCH DATE TBD, NUMBER OF FLIGHTS IN SERIES 1 + 4

B. L. S. INDEX FACTOR* 1.435 AS OF 1 April 79 :: STANDARD $ 18.271 (75SM) PLUS USE FEES $ 4.298

OPTIONAL FLIGHT SYSTEM INFORMATION

DESCRIPTION:

N/A

23

PAYLOAD RELATED OPTIONAL SERVICE INFORMATION

OPTION DESCRIPTION	ESTIMATE	OPTION DESCRIPTION	ESTIMATE
1. Analog MDM Harnesses	.001M		
2. Design Support Loads Cycle	N/A		
3. Super Guppy transportation from LAX to KSC	.080M		
4. KSC Management & Support			
a) Facility use charge	.112M		
b) Optional Service Package (OSP)	.232M		
c) Delta to OSP	.007M		

10/12/79

*ESTIMATES SUBJECT TO ESCALATION ACCORDING TO THE BUREAU OF LABOR STATICS (B.L.S.) INDEX AS DEFINED IN THE NASA REIMBURSEMENT POLICIES NMI 8610.8 AND NMI 8610.9; USE FEES ARE NOT SUBJECT TO ESCALATION

!!!NOTICE!!! THESE ESTIMATES ARE IN CURRENT YEAR DOLLARS. THE BILLINGS WILL BE IN FUTURE VALUE DOLLARS!!

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Figure 13-1.- Summary Cost Estimates (Concluded).

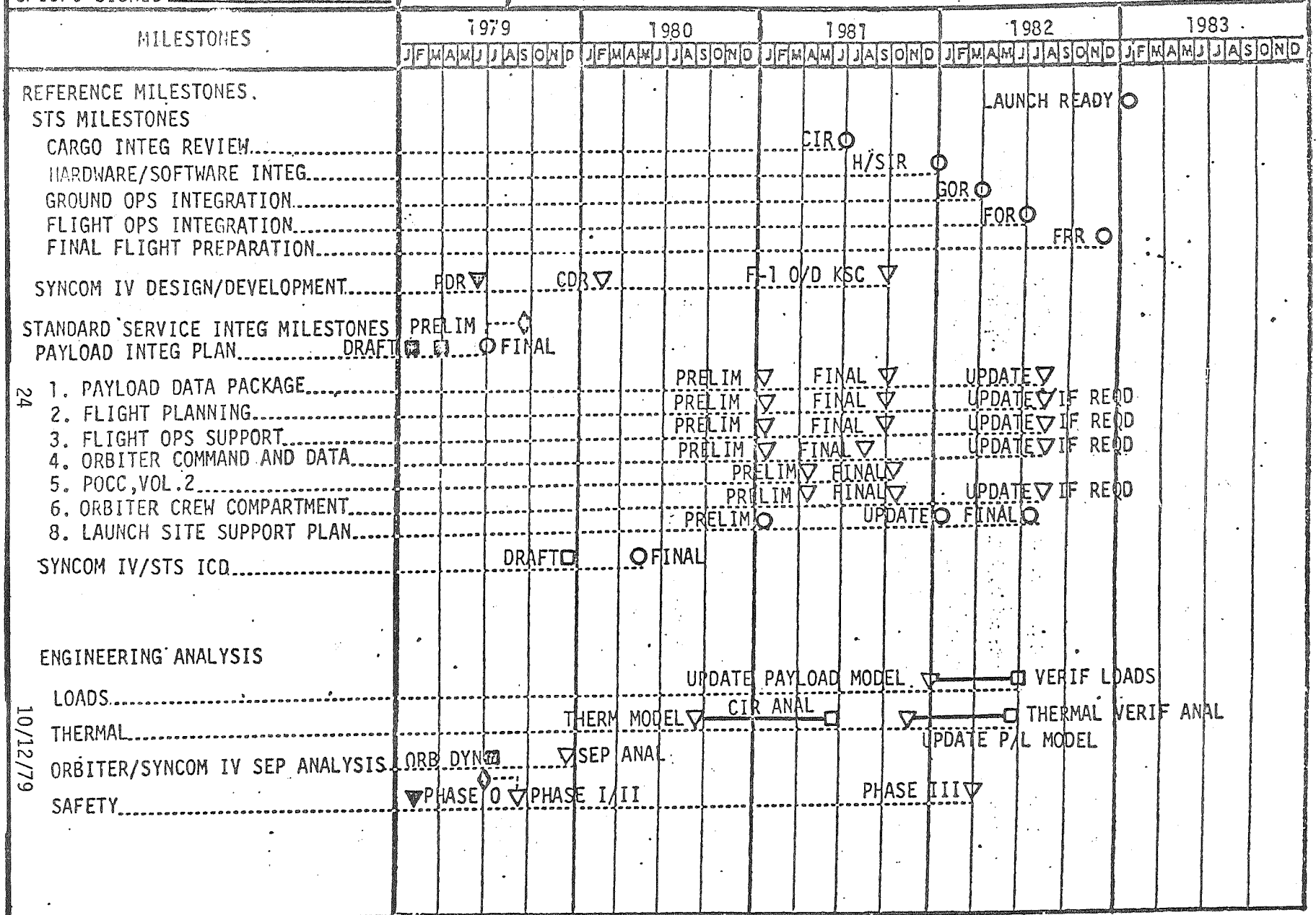
P.E. J.LOWE PHONE NO. 5923
PIP NO. JSC 14000, REV. A
SPIDPO SIGNED

□ STS
▽ P/L
○ JOINT

SYNCOM IV/STS INTEGRATION SCHEDULE

1.

SEPT. 19, 1979



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10/12/79

Figure 15-1.- SYNCOM IV/STS Integration Schedule.

P.E. J.LOWE PHONE NO. 5923

PIP NO. JSC 14000,REV.A

SPIDPO SIGNED

□ STS
▽ P/L
○ JOINT

SYNCOM IV/STS INTEGRATION SCHEDULE (CONT'D)

2

SEPT.19,1979

MILESTONES	1979 J F M A M J J A S O N D	1980 J F M A M J J A S O N D	1981 J F M A M J J A S O N D	J F M A M J J A S O N D	1983 J F M A M J J A S O N D
OPTIONAL SERVICES INTEGRATION MILESTONES					
ANALOG MDM HARNESSES			EPS□ DESIGN□	DELIVERY□	USE
LOADS ANALYSIS	EPS□ ▽ P/L LOADS □□ MODEL REPORT				
SUPER GUPPY TRANSPORTATION			EPS□	USE▽	
KSC OPERATIONS AND USE				EPS□ USE▽	▽

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10/12/79

Figure 15-1.- SYNCOM IV/STS Integration Schedule (Concluded).

APPENDIX A

To Be Resolved items

1. Ref paragraph 4.3.1.2 Launch Window. STS requires that the capability exists to launch either near noon GMT or near midnight GMT for any given launch date.

   Syncom IV desires a near noon GMT launch between April 17 and September 20 and a near midnight GMT launch between October 17 and March 17. Remaining dates require a near noon or a near midnight GMT launch.

2. Ref paragraph 9.5 Aborted Missions. STS requires that HCSI be prepared to accept the payload at the contingency landing site after removal. HCSI agrees to supply the GSE but requests the payload be returned to the KSC launch site by the STS.

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